

IN THE SENATE OF THE UNITED STATES.

JUNE 7, 1858.—Ordered to be printed.

Mr. ALLEN submitted the following

REPORT.

The Committee on Commerce, to whom were referred "two memorials of merchants and others, citizens of New York and Brooklyn, praying the adoption of measures for ascertaining the correctness of certain alleged discoveries of guano on Jarvis and Baker's islands, in the Pacific ocean, the quality of the guano and its accessibility to merchant vessels," have had the same under consideration, and present the information desired by the memorialists in the accompanying documents, obtained from the Navy Department and other sources, and request that the same be printed as part of their report.

NAVY DEPARTMENT,
May 21, 1858.

SIR: Referring to my letter of the 4th, in reply to yours of the 1st instant, I now have the honor to transmit herewith copies of the orders of the department under which Commodore Mervine, commanding the Independence, and Commander Davis, commanding the St. Mary's, visited New Nantucket and Jarvis islands, in the Pacific, said to possess deposits of guano; also, copies of their reports to the department, together with charts embracing sailing directions of those islands.

I am, very respectfully, your obedient servant,

ISAAC TOUCEY.

Hon. PHILIP ALLEN,
Committee on Commerce, United States Senate.

No. 1.

[Forwarded by William Mervine, commanding Pacific squadron.]

UNITED STATES FLAG SHIP INDEPENDENCE,
At Sea, March 18, 1856.

SIR: In obedience to your order, I left this ship in the whale boat, which hove to close under the lee of Nantucket island on the afternoon of the 15th instant, for the purpose of finding a practicable

anchorage. I pulled as close into the outer breakers in several places, between the points forming the lee side of the island, as was consistent with safety, discovering no bottom with thirty-six fathoms line. The sand beach appeared to extend about ten or twelve feet above the sea, rising abruptly, perhaps at an angle of forty-five degrees. Above the sand there is about ten feet of vegetation, apparently short, coarse grass, and low bushes. The breakers were not only heavy, but exceedingly irregular, owing, doubtless, to the strong easterly current. From a long experience in landing through surf, I can confidently state that it would have been dangerous to attempt a landing at that time, although a good whale boat might do so at some other season.

This beach embraces all the lee side of the island, and, from appearances, I am confident that a landing cannot be safely made on the other.

I am also satisfied that there is no anchorage on the lee or southwest side of the island.

Very respectfully, your obedient servant,

J. B. McCAULEY,

Lieutenant United States Navy.

Commodore WILLIAM MERVINE,

Commanding U. S. Naval Forces, Pacific Ocean.

No. 2.

NAVY DEPARTMENT,

March 3, 1857.

SIR: In despatching a vessel of the squadron under your command to Jarvis island, as directed by the order of the department, addressed to you on the 28th ultimo, you will, if perfectly agreeable to the officers of such vessel, grant a passage to Captain Lewis, who, it is understood, is well acquainted with and can point out the various landing places. He will, of course, pay his proportion of mess expenses.

Very respectfully, your obedient servant,

J. C. DOBBIN.

Commodore WILLIAM MERVINE,

Commanding U. S. Squadron, Pacific Ocean.

No. 3.

Extract from Commodore William Mervine's orders to Commander Davis.

UNITED STATES FLAG SHIP INDEPENDENCE,
Bay of Panama, June 12, 1857.

SIR: * * * * *

You will proceed hence, with the United States ship St. Mary's under your command, to Jarvis island, in latitude $0^{\circ} 22' 23''$ north, and longitude $159^{\circ} 41' 11''$ west, with a view to making soundings, ascertaining its locality, and the quantity and quality of the guano said to exist upon it, and making such hydrographical and barometrical ob-

servations in connexion with the island as may be useful to the interest of navigation.

Having completed these duties, you will proceed to New Nantucket, situated in latitude $0^{\circ} 15'$ north, and longitude $176^{\circ} 30'$ west, where you will make the same investigations as those directed at Jarvis island.

It is desirable that you obtain several samples of guano from each island, if any be found thereon, selecting a sufficient variety to illustrate the character of the deposits.

A claim has been made by an association styled the "American Guano Company," to the proprietorship of these islands, and it is the intention of our government to protect this claim, if ascertained to be well founded, and to exercise sovereignty over the islands themselves.

You will, therefore, in the event of no conflicting claims appearing, take formal possession of them in the name of your government.

Having executed this commission, you will repair, by way of the Sandwich Islands, to the navy yard, Mare Island, California, where you will effect such repairs upon the *St. Mary's* as she shall require, and where you will find instructions for your future guidance.

You will deposit your specimens of guano with the commandant of the yard, subject to the order of the Secretary of the Navy, and address your report directly to the department, with a duplicate to myself.

Very respectfully, your obedient servant,

WILLIAM MERVINE,

Commanding United States Pacific Squadron.

Commander C. H. DAVIS,

Commanding United States Ship St. Mary's.

No. 4.

UNITED STATES SHIP *ST. MARY'S*,
Harbor of Honolulu, October 3, 1857.

SIR: I respectfully request the attention of the department to the following statement.

The principal assertions or points contained in the report of Commodore Mervine of June 30, 1856, concerning New Nantucket island, are as follows:

1. He was unable to land.
 2. He found the island covered with vegetation.
 3. He inferred that there was no guano on it.
 4. He found no suitable anchorage.
 5. He sounded in 36 fathoms of water, near the breakers, without getting bottom.
 6. He found no opening in the fringing reef for the passage of boats.
- It was the fortune of the *St. Mary's* to be at New Nantucket island at a season favorable for landing.
- It was the fortune of the *Independence* to be at New Nantucket island at a season unfavorable for landing, and also for maintaining

the ship's position near the island ; the landing or not landing upon an exposed sea-beach is regulated by the existing state of the weather.

I have the honor to say to the department that, with this exception of landing, which is rather the result of an accident than a real exception, the opinions and conclusions of Commodore Mervine, cited above, are fully confirmed by our actual observations.

Very respectfully, your obedient servant,

CHARLES HENRY DAVIS,
Commander.

Hon. ISAAC TOUCEY,
Secretary of the Navy, Washington, D. C.

No. 5.

UNITED STATES SHIP ST. MARY'S,
Navy Yard, Mare Island, Cal., February 27, 1858.

SIR : I have the honor to transmit to you the result of an analysis of Jarvis and New Nantucket islands soils, made under the direction of the department of agriculture, commerce, and public works at Paris, and communicated to me by the French commissioner at the Hawaiian islands, who received it from Count Walewski.

It may be presumed that this analysis, coming from the source it does, was made either by Banssingault, (to whom Liebig ascribes a high authority in the analysis of manures,) or by Dumas, or by some other equally distinguished analyst.

Very respectfully, your obedient servant,

CHARLES HENRY DAVIS,
Commander.

Hon. ISAAC TOUCEY,
Secretary of the Navy, Washington, D. C.

No. 6.

[Translation.]

FRENCH LEGATION AT THE HAWAIIAN ISLANDS,
Honolulu, January 25, 1858.

CAPTAIN : In compliance with your request, I have the pleasure to inform you that the result of the examination to which the guano found at Jarvis, Howland, and New Nantucket islands has been subjected, has furnished the following particulars :

00.25 of azole.

16.50 of phosphate of lime.

This analysis has been made by commissioned experts attached to

the department of agriculture, commerce, and public works, as has been recently communicated to me by his excellency Count Walewski.

Accept, captain, the renewed assurance of my distinguished consideration.

EM. PERRIN,
Consul and Com'r of his Imperial Majesty.

Captain DAVIS,
Of the Sloop-of-war St. Mary's, Honolulu.

No. 9.

NAVY DEPARTMENT,
March 8, 1858.

SIR: Transmitted herewith is a box containing several samples of the soil or deposits of Jarvis and New Nantucket islands, in the Pacific ocean, which were collected and sent to the department by Commander Charles H. Davis, commanding United States ship St. Mary's.

The department requests that you will cause these samples to be analyzed, with the view to ascertain their true character, and to what extent they possess the properties of guano. The expense of the analysis will be borne by this department.

I am, respectfully, your obedient servant,

ISAAC TOUCEY.

Professor JOSEPH HENRY,
Secretary Smithsonian Institution, Washington, D. C.

No. 10.

SMITHSONIAN INSTITUTION,
Washington, May 28, 1858.

SIR: In accordance with the request contained in your letter of March 8, 1858, that we would cause to be analyzed samples of the soil or deposits of the New Nantucket and Jarvis islands, in the Pacific ocean, we employed two chemists, in whose knowledge and practical skill we have full confidence, to make the investigations required in the laboratory of the Smithsonian Institution.

The report, which I have the honor herewith to transmit, contains a brief account of the results which they have obtained, which, we trust, will be sufficient for the purposes of the department. Should any further information be required, we will endeavor to furnish it.

From this report it will be seen that the deposits submitted to examination do not possess the peculiar characteristics of Peruvian guano, although of the same origin, and are not equal to it in value. In some cases they might be considered as valuable as bone dust, but not generally. They differ from the latter in being almost entirely deficient in nitrogeneous matter, and therefore their importance for agri-

cultural purposes depends upon their mineral ingredients, which are of a valuable character, being the same as the inorganic matter of bones. The want of nitrogeous matter, however, renders a strict comparison between them and bone dust impossible.

I have the honor to be, very respectfully, your obedient servant,
JOSEPH HENRY,
Secretary Smithsonian Institution.

Hon. I. TOUCEY,
Secretary of the Navy.

WASHINGTON, D. C., May 27, 1858.

DEAR SIR: We herewith transmit the results of the examination of a number of specimens sent to you from the Navy Department for the purpose of ascertaining their chemical composition, as far as relates to their commercial value.

It is understood that these specimens were supposed to be guanos, or similar substances, having properties rendering them useful as manures, and it is to the determination of this that we have devoted our whole attention.

The specimens were 17 in number, and the labels attached to them indicated that nine of them were brought from "New Nantucket island" by the United States vessel *St. Mary's*, and eight from "Jarvis island" by the same vessel. There were no distinctive marks otherwise attached to the specimens, from which we were led to the conclusion that they were selected as samples from different parts of the respective islands, and were intended to give the average, as far as could be determined by eye, of the product of each.

The specimens were contained in the tin cases used for preserved meats, &c., and were hermetically sealed by solder, as we ascertained by careful inspection, and as was confirmed by the results of our subsequent examination. We deem it necessary particularly to note this fact, for, as we have indirectly learned, the specimens were obtained some time ago, and we feel authorized to say that they have neither lost nor gained anything since they were sealed, and the evidence is conclusive that they must have been sealed soon after they were obtained on the respective islands. Distinctive labels were attached to the cans as they were opened and examined, those from New Nantucket island being marked by the letters A, B and I, and those from Jarvis island by the letters K and S.

Essential differences between the products of the two islands having been developed by our later investigations, we proceed to give the results, nearly concordant among themselves, as derived from the examination of the products of each island separately.

We will first consider the specimens from New Nantucket.

These were found to be quite moist, and we immediately proceeded to determine the quantity of water in them, which could be driven off by exposure to the heat of boiling water, (212° Fah.) The greatest amount found was 33 per cent., the least 21 per cent.; the average of all the specimens from this island being 27.87 per cent.

Upon free exposure to the air of the laboratory, this water was given off, with the exception of about 3 per cent.

We next proceeded to examine the residue left, after drying at 212° . The organic matter present was evidently, in part at least, vegetable, as the fibrous portions of roots were seen throughout the mass. The residue was ignited, by which treatment all organic matter would be burned off. The smell in all cases was that of peat or moor soil, being that of vegetable and not of animal matter; sometimes a faint ammoniacal odor could be discovered.

The organic matter thus determined was found to be 10.6 per cent. for a maximum, and 8.4 per cent. for a minimum, or, on an average of all the specimens, $9\frac{1}{2}$ per cent. of the dried material. A part of this loss was due to water retained at the temperature of 212° , and a part to the very small quantity of ammonia which escaped. The nature of the matter thus lost was not dissimilar to that contained in ordinary soils; the quantity, however, was much greater, but even larger quantities of the same matter have been found in unproductive soils.

The residue, after ignition, was found to contain mainly phosphate of lime, (bone earth,) with small quantities of magnesia, iron, and soda, and in all of the specimens the soluble salts were very small in quantity. Before ignition a little carbonate of lime was detected.

We next proceeded to consider the specimens from Jarvis island, which differed materially from the last. The quantity of water was less than that found in the specimens from the other island, being about $18\frac{1}{2}$ per cent. on an average.

The dried material lost, of organic matter, by ignition, 12.4 per cent., on an average. This matter showed the same character as that above described. The residue contained phosphate of lime, with a small quantity of magnesia, a large quantity of sulphate of lime and soda, and about 4 per cent. of chloride of sodium, (common salt.) Iron and carbonate of lime were also present in small quantity.

In burning, the products of this island uniformly gave a whiter ash than those of the last, which first gave a suspicion of the presence of a larger quantity of sulphate of lime. Some of the specimens from the other islands showed not the slightest trace of this substance. A precise determination of the whole quantity of ammonia capable of being obtained, gave for one of the specimens less than one-third of 1 per cent. of the dry material.

The products from both of these islands have evidently been derived from the excrement of sea birds. The term guano was originally applied to the deposits on islands upon which rain rarely or never falls, and on which, in a dry atmosphere, the matter was preserved almost unchanged. Such guanos contained not only inorganic matter, as the phosphates supplying needful ingredients to our crops, ammoniacal salts, capable of invigorating, or, to use the common word, "stimulating" their growth, but also "animal matter" capable of furnishing, by its slow decomposition under the influence of heat and moisture, ammonia for a long period.

By general usage, the term guano has been extended in meaning until made to include any and every product derived from the excrement of sea birds, even when this has assumed the character of a solid

rock, only valuable for agricultural purposes by its mineral or inorganic constituents.

In both of these islands the salts of ammonia have been reduced to a minimum, and it is doubtful whether any more ammonia is present than can be obtained from the phosphate of magnesia and ammonia, a form most favorable for the preservation of this important constituent. In the specimens from "New Nantucket," it would seem that drenching rains and a high temperature had never allowed the excrement of sea birds to attain the condition represented by Peruvian guano, nearly all soluble salts having been removed, and all organic matter capable of furnishing nitrogen in the form of ammonia having been decomposed.

In the specimens from "Jarvis island," it would seem that sea water had produced a similar effect, with the exception of the introduction of a larger quantity of sulphates and chlorides.

Without a more precise description of the climate and of the actual condition of the islands, we cannot undertake to say what changes the deposits have undergone; we can only presume that if the specimens fairly represent the deposit, no portion at the present time is in the condition of Peruvian guano.

This presumption is also sustained by the quantity of vegetable matter present, in the shape of the fibrous roots of plants, which have evidently grown upon the spot. No true unaltered guano would, by itself, support vegetable life.

We can say, however, without hesitation, that the products from these islands depend for their value as manures almost solely upon their mineral or inorganic constituents.

As to the worth of these substances, we can best represent it by comparison with bones, which are nearer to them in composition than any other common material.

Bones, however, are valuable as manure, by reason of their mineral matter, phosphate of lime, &c., and also by their animal matter. This latter, by slow decomposition, furnishes year after year something to the plant in the shape of ammonia.

The phosphate of lime being an important constituent of all our cereal grains, is, by itself, a desirable addition to a soil. This can easily be understood when it is remembered that nearly the whole of the bones of all animals is originally derived from the bone earth in vegetable food.

The specimens we have examined contain a larger per centage of phosphate of lime than bones contain; they have also rather more phosphoric acid than bone earth, and are in a finely divided condition, so that the useful matter can be readily taken up when applied to crops.

Bones contain about one-tenth less of phosphates than the "New Nantucket" deposit in its moist state, and about one-third less than the same material when dry.

The "Jarvis island" deposit contains a fourth less of phosphates than the other, but it is not so uniform; and the sulphate of lime, (gypsum,) although a useful ingredient, tends to form lumps or masses which are too tough to be reduced without grinding.

Bones, when ground, are worth $1\frac{1}{3}$ cent per pound; hence it would be easy to determine the relative value, if the mineral matter alone were concerned. But bones contain also animal organic matter, to which, in part, they owe their value as manure; the specimens examined contain almost none of this.

We cannot therefore make an absolute comparison of the value of these deposits and of bones; for the former contain one kind of useful matter, the latter two kinds, which cannot take the place of each other, as they perform different offices for the plant.

The quantity of phosphates required for any given crop can easily be calculated; and if we add to the soil a sufficiency of these to last for several years, we can gain nothing by adding more of them. In loose soils any excess would be a waste, as it would be washed down and lost.

The maximum of good effect by the addition of such substances as those we have examined would soon be attained, and the hope of continued benefit by continued additions would not be realized.

Bones, on the other hand, supply animal matter, which may be often renewed with benefit, even if an excess of phosphates is thereby added to the soil.

We have aimed at a correct statement of the value of these deposits; and as it depends upon the relative value of mineral and organic matters as manures, we have felt compelled to dilate somewhat upon this point in order to prevent mistake.

The quantity of water contained in the specimens is a somewhat serious drawback upon their value. This, and the nearly useless vegetable matter, would together involve the transportation with each ton of one-third of a ton of inert substances.

Whether drying upon the islands would be practicable we cannot say; the nearly uniform moisture of all the specimens seems to indicate too moist an atmosphere for carrying on the drying process.

To aid in giving a general view of the value of the specimens, we append a table showing the per centage in each of the water of the matter lost by burning and of the fixed residue.

Any further information or explanations that may be desired in regard to this matter we shall be happy to furnish.

The above statements have been drawn up in accordance with your request for an immediate report; we believe, however, that they contain everything material to the answer of the questions proposed.

TABLE.

Per centage on different specimens from New Nantucket.

Specimen.	Water.	Organic matter.	Residue of fixed salts.
A.	21.07	6.6	72.33
B.	28.30	6.7	65.00
C.	33.04	6.0	61.00
D.	30.40	6.5	63.00
E.	28.80	6.5	64.70
F.	27.30	6.4	66.30
G.	28.00	6.9	65.00
H.	25.80	7.4	67.00
I.	27.94	7.7	64.36
Average,	27.87	6.744	*65.41

From Jarvis island.

Specimen.	Water.	Organic matter.	Residue of fixed salts.
K.	17.20	11.80	71.00
L.	23.60	7.70	68.70
M.	18.00	11.20	71.00
N.	14.88	9.90	75.00
O.	13.50	12.00	74.50
P.	18.00	11.40	70.60
R.	21.00	10.25	69.75
S.	21.04	6.80	72.00
Average,	18.2775	10.156	†71.57

We are, very respectfully, your obedient servants,

GEO. C. SCAFFOR, M. D.

B. FANUEIL CRAIG, M. D.

Professor JOSEPH HENRY,

Secretary of the Smithsonian Institution.

* This residue consists of from 80 to 90 per cent. of phosphate of lime, (tribasic,) and from 10 to 20 per cent. of other phosphates.

† This residue contains from 64 to 72 per cent. of tribasic phosphate of lime, the remainder being sulphate of lime and of other bases, chloride of sodium, and carbonate of lime.